NUREG/CR-3795

Closeout of IE Bulletin 82-04: Deficiencies in Primary Containment Electrical Penetration Assemblies

Prepared by W. J. Foley, A. Hennick

PARAMETER, Inc.

Prepared for
U.S. Nuclear Regulatory Commission

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Closeout of IE Bulletin 82-04: Deficiencies in Primary Containment Electrical Penetration Assemblies

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Prepared for
Division of Emergency Preparedness and Engineering Response
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
NRC FIN B8714

ABSTRACT

IE Information Notice 82-40 was issued September 22, 1982 as an early notification of a potentially significant problem pertaining to electrical penetration assemblies (EPAs) supplied by the Bunker Ramo Corporation (BRC) of Chatsworth, California. All deficiencies described in the Notice were identified as existing in BRC EPAs with a hard epoxy module design. Utility personnel were asked to review the Notice and take appropriate actions, but were not required to respond or take any specific action. After further study, NRC concluded that there were potential generic safety implications at a limited number of plants. Accordingly, IE Bulletin 82-04 was issued December 3, 1982 to require responses and specific actions by all licensees and holders of construction permits. Evaluation of utility responses, deficiency reports and NRC/IE inspection reports has resulted in Bulletin closeout for 124 of the 129 current facilities. Deficiencies described in the Bulletin were identified at 11 facilities, of which two are operating and nine are under construction. Followup of corrective actions and verification of inspection procedures are proposed in Appendix C for the five facilities with open status. Inspection findings and the replacement/repair status of the 11 facilities with affected assemblies are summarized in Table B.6. Completion by NRC/IE of all the followup items identified in Appendix C is expected to resolve fully the specific problem of Bunker Ramo electrical penetrations that utilized a hard epoxy design.

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CLOSEOUT OF IE BULLETIN 82-04: DEFICIENCIES IN PRIMARY CONTAINMENT ELECTRICAL PENETRATION ASSEMBLIES

Introduction

In accordance with the Statement of Work in Task Order 52 under Contract NRC-05-82-249, this report provides documentation for the closeout status of IE Bulletin 82-04. The following documentation is based on the records obtained from the IE File, the NRC Document Control System and the Cognizant Engineer's File.

IE Bulletin 82-04 was issued December 3, 1982, because of concern about potential generic safety implications at a limited number of plants. The problem arose from deficiencies in electrical penetration assemblies supplied by the Bunker Ramo Corporation of Chatsworth, California. All deficiencies described in the Bulletin were identified as existing in assemblies with a hard epoxy module design.

For background information, IE Information Notice 82-40, IE Bulletin 82-04 and IE Temporary Instruction 2512/09 are included in Appendix A. Also included is a brief explanation of initial concern about the potential problem in operating facilities.

Documentation of Bulletin closeout is presented in Appendix B. Proposed followup items are presented in Appendix C.

Summary

1. The Bulletin has been closed out automatically for 34 non-current facilities, per Criterion 1.

2. The Bulletin has been closed out for 118 current facilities which have no affected assemblies, per Criterion 2.

3. The Bulletin has been closed out for two current facilities for which corrective actions are to be tracked by NRC/IE as 10 CFR 50.55(e) Construction Deficiency Report Items and in accordance with instructions specified in TI 2512/09, per Criterion 3.

The facilities closed out per Criterion 3 are Midland 1 and 2, both of which are under construction.

4. The Bulletin has been closed out for four current facilities per Criterion 4, which requires an NRC/IE inspection report indicating that corrective actions have been completed in accordance with instructions specified in TI 2512/09.

   The facilities closed out per Criterion 4 are Arkansas 2, Callaway 1, LaSalle 2 and Wolf Creek 1. Arkansas 2 is operating; the others are under construction.

5. The Bulletin is being held open for five facilities, namely Braidwood 2, Byron 2, Comanche Peak 1 and 2, and San Onofre 1. Only San Onofre 1 is operating; the others are under construction.

6. Inspection findings and the replacement/repair status of all 11 facilities with affected assemblies are summarized in Table B.6. Arkansas 2, Braidwood 2, Byron 2, Callaway 1, Comanche Peak 1 and 2, LaSalle 2, Midland 1 and 2, San Onofre 1 and Wolf Creek 1 are listed in this table. Arkansas 2 and San Onofre 1 are operating; the remaining facilities are under construction.

Conclusions

1. The initial conclusion in IE Bulletin 82-04 stating that there were potential generic safety implications at a limited number of plants is valid.

   Utility personnel of only 11 current facilities have reported the use of affected assemblies supplied by the Bunker Ramo Corporation. These facilities are identified in preceding Summary Items 3, 4 and 5. Of these facilities, only Arkansas 2 and San Onofre 1 have reported affected assemblies which require no corrective action.

2. Consistent and effective followup of corrective action at facilities with affected assemblies supplied by the Bunker Ramo Corporation is assured by the requirements of IE Temporary Instruction 2512/09.

Remaining Areas of Concern

1. As noted in preceding Summary Item 5, the Bulletin is being held open for Braidwood 2, Byron 2, Comanche Peak 1 and 2, and San Onofre 1. Proposed followup items are presented in Appendix C.

2. As noted in preceding Summary Item 3, the Bulletin has been closed out for Midland 1 and 2. A proposed followup item is presented in Appendix C to ensure tracking on a separate NRC/IE system.

Recommendation

IE Bulletin 82-04 deals with the specific problem of Bunker Ramo electrical penetrations that utilized a hard epoxy design. Completion of all the followup items identified in this report is expected to fully resolve this problem. No further actions (e.g., change in licensing reviews) have been identified as needed to achieve a long-term resolution of this issue.

Definitions Used with Criteria for Closeout of Bulletin

1. An affected assembly is an electrical penetration with a hard epoxy module supplied by the Bunker Ramo Corporation and used or planned for use in a safety-related system.

2. An acceptable response is a clearly written reply submitted by utility personnel, in compliance with actions required by the Bulletin.

3. An adequate repair or replacement action is a corrective action which is applied to or planned for an affected assembly, in essential compliance with the requirements of Temporary Instruction 2512/09.

Criteria for Closeout of Bulletin

The Bulletin is to be closed out for a facility to which one of the following criteria applies:

1. The facility has been cancelled, deferred indefinitely or shut down indefinitely.

2. An acceptable response has been submitted for the facility, indicating that it has no affected assemblies.

3. An acceptable response and an applicable 10 CFR 50.55(e) Construction Deficiency Report have been submitted for the facility, indicating that adequate repair/replacement of affected assemblies will be implemented or has been completed, and ensuring that corrective actions will be tracked by NRC/IE on a separate tracking system.

4. An acceptable response has been submitted for the facility, indicating that adequate repair/replacement of affected assemblies will be implemented or has been completed; and an NRC/IE inspection report has been received verifying that corrective actions have been completed in accordance with instructions specified in TI 2512/09.

   An acceptable response indicating that the facility has affected assemblies which do not require corrective action is included in this category as a special case. An NRC/IE inspection report or equivalent documentation is needed to verify that the affected assemblies were inspected in accordance with the requirements of IE Bulletin 82-04.

References

1. United States Nuclear Regulatory Commission, Licensed Operating Reactors, Status Summary Report, Data as of 11/30/83, NUREG-0020, Volume 7, Number 12, December 1983

2. United States Nuclear Regulatory Commission, Nuclear Power Plants, Construction Status Report, Data as of 06/30/82, NUREG-0030, Volume 6, Number 2, October 1982

3. United States Nuclear Regulatory Commission, Code of Federal Regulations, Energy, Title 10, Chapter 1, January 1, 1983

4. United States Nuclear Regulatory Commission, Region II, Region II Status of IEB 82-04 Bunker Ramo Electrical Penetrations, Memorandum for E. L. Jordan from J. A. Olshinski, April 19, 1983

5. United States Nuclear Regulatory Commission, Region IV, Report No. 99900116/82-01, Inspection of Bunker Ramo Corporation Facility at Chatsworth, California, May 1982

6. United States Nuclear Regulatory Commission, Region IV, Report No. 99900116/80-02, Inspection of Bunker Ramo Corporation Facility at Chatsworth, California, September 1980

7. United States Nuclear Regulatory Commission, Region IV, Report No. 99900116/80-01, Inspection of Bunker Ramo Corporation Facility at Chatsworth, California, January 1980

8. United States Nuclear Regulatory Commission, Region IV, Report No. 99900116/79-01, Inspection of Bunker Ramo Corporation Facility at Chatsworth, California, February 1979

APPENDIX A

BACKGROUND INFORMATION

IE Information Notice 82-40

IE Bulletin 82-04

IE Temporary Instruction 2512/09

Initial Concern About Potential Problem in Operating Facilities

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

September 22, 1982

IE INFORMATION NOTICE NO. 82-40: DEFICIENCIES IN PRIMARY CONTAINMENT ELECTRICAL PENETRATION ASSEMBLIES

Addressees:

All nuclear power plant facilities holding an operating license (OL) or construction permit (CP).

Purpose:

This information notice is provided as an early notification of a potentially significant problem pertaining to electrical connections in electrical penetration assemblies supplied by the Bunker Ramo Corporation of Chatsworth, California. The potential safety significance and related generic implications of this problem as it applies to operating plants and plants under construction are still under review by the Nuclear Regulatory Commission (NRC) staff. If the NRC evaluation so indicates, further licensee action may be requested. In the interim, we expect the recipients of this Information Notice to review the information herein for applicability to their facilities and to take appropriate actions. No specific action or response is required at this time.

Description of Circumstances:

Several deficiencies of the containment's electrical penetration assemblies supplied by Bunker Ramo, have been identified. A summary of these deficiencies is provided below:

1. On January 15, 1979, Consumer Power Company submitted 10 CFR 50.55(e) report No. 78-12 for the Midland nuclear facility identifying deficiencies associated with #10 AWG and smaller wire terminations located in the inboard terminal boxes of Bunker Ramo penetration assemblies. The deficiencies identified included improper lug crimps, incorrect lug types, and loose connections on terminal blocks. These deficiencies were attributed, in part, to an inexperienced employee at Bunker Ramo.

2. On March 26, 1980, Union Electric Company submitted 10 CFR 50.55(e) report No. 80-03 for the Callaway nuclear facility identifying deficiencies associated with electrical penetration assemblies supplied by Bunker Ramo. The deficiencies included improperly crimped lugs and improperly identified penetration cables. During hand-pull tests at least 38 wires separated from their lugs. It was reported that this deficiency resulted when Bunker Ramo overcrimped and undercrimped lugs.

3. On June 12, 1980, the NRC was informed by Standardized Nuclear Unit Power Plant Systems (SNUPPS) that additional inspections at the Wolf Creek nuclear facility identified further concerns regarding the quality and integrity of Bunk Ramo electrical penetration terminations. Deficiencies identified at the Wolf Creek facility included improperly crimped lugs and incorrectly sized lugs.

4. On October 2, 1980, Commonwealth Edison submitted 10 CFR 50.55(e) report No. 80-02 for the LaSalle County Station Unit 2 facility identifying cracked or missing insulation (exposing bare copper) on small-diameter conductors as they enter/exit the epoxy module portion of the Bunker Ramo electrical penetrations. The report stated, in part, "The cracking was determined to have resulted from stress points in the insulation created by a mechanical bond between the potting compound (used to form the over-mold portion of the module) and the insulation. Movement of the conductors entering or exiting the modules produced cracks along the stress points." Subsequent to this report, LaSalle experienced failures while testing several Bunker Ramo fabricated in-line butt splices in modules that had been installed.

5. On March 31, 1982, the NRC was advised through a 10 CFR 21 report that deficiencies have been identified in Bunker Ramo electrical penetrations installed at the Midland nuclear facility. The deficiencies involve #2, #6, #8, #10, #14, and #16 AWG splices and cracks in the insulation of some conductors as they emerge from certain types of modules. The deficiencies were reported to have occurred when site personnel moved cables to inspect for rodent damage.

6. On April 8, 1982, Consumers Power Company submitted 10 CFR 50.55(e) report No. 82-02 for the Midland nuclear facility identifying deficiencies in Bunker Ramo electrical penetrations. The identified deficiencies include cracks in conductor insulation at the conductor-module interface (resulting in some exposure of the module's copper conductors) and inadequately crimped butt splices (resulting in several #2 AWG butt splices being pulled apart). These deficiencies were observed in installed electrical penetrations. In addition, similar deficiencies were observed in crated electrical penetrations and spare module assemblies stored in warehouse facilities. The cracked insulation was reported to have been probably caused by a chemical/mechanical reaction between the module materials, mechanical stresses resulting from the module design, and a lack of explicit handling/packing instructions reflecting the frailty of the electrical penetrations/modules. The inadequately crimped butt splices were reportedly caused by a breakdown in the fabrication/design of the module assemblies.

The above deficiencies have all been identified as existing in Bunker Ramo electrical penetrations utilizing a hard epoxy module design. Specifically, the study concluded that the over- and undercrimping problem was, in part, caused by using different sized wire cable for the same in-line butt splice connector. This resulted in the numerous over- and undercrimping connections (e.g., Midland and LaSalle Station plants) found in splices supplied by Bunker Ramo. It appears that if wirecrimping force adjustments had been made to accommodate the different wire sizes, as discussed above, the over- and undercrimping problem would have been significantly alleviated.

The loose terminations and poor crimping of ring nut connectors found in the terminal boxes supplied by Bunker Ramo appears to have been attributed to poor quality control and assembly line techniques at the fabrication facility.

The problems of incorrect lug sizes and improper crimping may also exist in the earlier Bunker Ramo penetration assembly design which utilizes a soft epoxy module.

If you have any questions regarding these matters, please contact the administrator of the appropriate Regional Office or this office.

Edward L. Jordan, Director
Division of Engineering and
Quality Assurance
Office of Inspection and Enforcement

Technical Contact V. D. Thomas
301-492-4967

Attachment:
List of Recently Issued IE Information Notices

SSINS 6820
OMB No.: 3150-0094
Expiration Date: 11/30/85
IEB 82-04

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

December 3, 1982

IE BULLETIN NO. 82-04: DEFICIENCIES IN PRIMARY CONTAINMENT ELECTRICAL PENETRATION ASSEMBLIES

Addressees:

All nuclear power reactor facilities holding an operating license (OL) or construction permit (CP).

Purpose:

The purpose of this bulletin is to inform CP holders and licensees about findings from a joint Region III, Region IV, and IE study concerning electrical penetrations supplied by the Bunker Ramo Company. It was concluded that there are potential generic safety implications at a limited number of plants. Therefore, we ask all recipients of this bulletin to review the information herein for applicability to their facilities and (1) to take appropriate action with respect to deficiencies found if their plants utilize hard epoxy containment electrical penetration assemblies manufactured by the Bunker Ramo Company or (2) submit reports stating that such assemblies are not used in their facilities.

Description of Circumstances:

Several deficiencies in containment electrical penetrations supplied by Bunker Ramo, have been identified. A summary of these deficiencies is provided below:

1. On January 15, 1979, Consumer Power Company submitted 10 CFR 50.55(e) report No. 78-12 for the Midland nuclear facility identifying deficiencies associated with #10 AWG and smaller wire terminations located in the inboard terminal boxes of Bunker Ramo penetration assemblies. The deficiencies identified included improper lug crimps, incorrect lug types, and loose connections on terminal blocks. These deficiencies were attributed, in part, to an inexperienced employee at Bunker Ramo.

2. On March 26, 1980, Union Electric Company submitted 10 CFR 50.55(e) report No. 80-03 for the Callaway nuclear facility identifying deficiencies associated with electrical penetration assemblies supplied by Bunker Ramo. The deficiencies included improperly crimped lugs and improperly identified penetration cables. During hand-pull tests, at least 38 wires separated from their lugs. It was reported that this deficiency resulted when Bunker Ramo overcrimped and undercrimped lugs.

3. On June 12, 1980, the NRC was informed by Standardized Nuclear Unit Power Plant Systems (SNUPPS) that additional inspections at the Wolf Creek nuclear facility identified further concerns regarding the quality and integrity of Bunker Ramo electrical penetration terminations. Deficiencies identified at the Wolf Creek facility included improperly crimped lugs and incorrectly sized lugs.

4. On October 2, 1980, Commonwealth Edison submitted 10 CFR 50.55(e) report No. 80-02 for the LaSalle County Station Unit 2 facility identifying cracked or missing insulation (exposing bare copper) on small-diameter conductors as they enter/exit the epoxy module portion of the Bunker Ramo electrical penetrations. The report stated, in part, "The cracking was determined to have resulted from stress points in the insulation created by a mechanical bond between the potting compound (used to form the over-mold portion of the module) and the insulation. Movement of the conductors entering or exiting the modules produced cracks along the stress points."

5. On March 31, 1982, the NRC was advised through a 10 CFR 21 report that deficiencies have been identified in Bunker Ramo electrical penetrations installed at the Midland nuclear facility. The deficiencies involve #2, #6, #8, #10, #14, and #16 AWG splices and cracks in the insulation of some conductors as they emerge from certain types of modules. The deficiencies were reported to have occurred when site personnel moved cables to inspect for rodent damage.

6. On April 8, 1982, Consumers Power Company submitted 10 CFR 50.55(e) report No. 82-02 for the Midland nuclear facility identifying deficiencies in Bunker Ramo electrical penetrations. The identified deficiencies included cracks in conductor insulation at the conductor-module interface (resulting in some exposure of the module copper conductors) and inadequately crimped butt splices (resulting in several #2 AWG butt splices being pulled apart). These deficiencies were observed in installed electrical penetrations. In addition, similar deficiencies were observed in crated electrical penetrations and spare module assemblies stored in warehouse facilities. The cracked insulation was reported to have probably been caused by a chemical/mechanical reaction between the module materials, mechanical stresses resulting from the module design, and a lack of explicit handling/packing instructions reflecting the fragility of the electrical penetrations/modules. The inadequately crimped butt splices were reportedly caused by a breakdown in the fabrication/design of the module assemblies.

The above deficiencies have all been identified on Bunker Ramo electrical penetrations utilizing a hard epoxy module design. In addition to the above construction sites, Bunker Ramo has identified the Comanche Peak, Byron and Braidwood sites as using this design. These deficiencies could result in failures of Class 1E equipment essential to the safe operation and shutdown of nuclear facilities. The potential failures which could occur include electrical short-circuits, localized circuit overheating, adjacent circuit cross-talk, and circuit discontinuities.

In addition to the above documented deficiencies associated with nuclear facilities under construction, a deficiency in Bunker Ramo electrical penetrations utilizing a soft epoxy module design has recently been identified at Davis-Besse, an operating nuclear facility. Davis-Besse has determined that spurious alarms are caused by intermittent voltage drops within the electrical penetration module assemblies. To determine the cause of the voltage drops, two module assemblies have been removed during the current refueling outage and will be shipped to a laboratory for testing. Calvert Cliffs, Trojan, and Arkansas plants also use the soft epoxy module design. A supplement to this bulletin will be issued, if deemed necessary, when the Davis-Besse laboratory results are available.

Actions to Be Taken by Holders of Operating Licenses or Construction Permits

1. Plants Under Construction and in Operation

   If Bunker Ramo electrical penetrations having module assemblies which utilize the hard epoxy module design are not yet installed in safety-related systems at your facility (plants under construction) or are non-installed spare units (operating plants), the following actions are requested:

   a. Inspect all supplier-provided electrical penetration terminal boxes and verify that the conductor terminations are satisfactory (correct lug sizes, proper crimps, and no loose connections).

   b. Inspect all electrical penetration conductors as they enter and exit penetration modules and verify the integrity of the insulation around the conductors. It may be necessary to remove the penetration modules from the assembly to perform this inspection, and removal will be necessary to conduct the examination discussed in Item c below.

   c. Conduct detailed examinations of all supplier-provided in-line butt splices having a wire size of #2 AWG and smaller, and ascertain acceptability of these connections.

2. Plants Under Construction

   If Bunker Ramo electrical penetration assemblies utilizing the hard epoxy module design are installed in safety-related systems at your facility, the following actions are requested:

   a. Inspect the accessible* portions of all installed assemblies as described in Items 1a and 1b above.

*Throughout this bulletin the accessible portions are considered to be all of the supplier-provided electrical terminations (see Item 1a) and those parts of the penetration modules (Item 1b) that can be inspected while the assemblies are in place.

b. Remove a sample of penetration modules from the assemblies and inspect the sample as described in Item 1b and 1c above. Minimum sample size considered acceptable shall be the greater of two modules or 10% of the modules for each wire size.

If failures are identified in either the non-installed assemblies (Items 1b and 1c) or in the sample from the installed assemblies, the sample size shall be appropriately increased.

3. Plants in Operation:

If Bunker Ramo electrical penetration assemblies utilizing the hard epoxy module design are installed in safety-related systems at your facility, you are requested to review past operational and related maintenance records of these electrical penetration units for circuit functionability problems similar to those discussed in this bulletin. If such problems have occurred, or if the inspection of spare assemblies in accordance with Item 1 have identified deficiencies, then the following actions are requested:

a. Provide a basis for continued plant operation if problems as discussed in this bulletin are identified.

b. Develop a plan for inspection of the installed assemblies. This plan should address the types of problems identified by past operational history and/or the inspection of non-installed spares. The plan should identify the wire sizes to be examined.

(1) If problems were only identified in accessible portions of the assembly then the sample may be restricted to that portion.

(2) If problems included inaccessible portions, then the sample shall include inaccessible portions of the assembly. This will require removal of the module from the assembly.

4. Repairs to conductor terminations, module insulation and butt splices identified as unacceptable under provisions of Items 1, 2 or 3 above shall be performed in accordance with appropriate procedures.

Initiate replacement or repair of any supplier-provided conductor termination, module insulation, or in-line butt splice if they are determined to be unacceptable based on the inspections and examinations discussed in Items 1 through 3 above. If the repairs involve recrimping of connection(s), such actions must be supported by documentation containing the results of the qualification tests conducted to support these corrective actions. This is to include pull tests on similarly installed sample connections from your facility. An acceptable alternative would be type

tests of recrimped connections of each wire size, performed by the connector manufacturer. These sample connections must be of similar parameters (i.e., wire size, connector type, qualified crimping tool and crimping procedures, etc.) as those of the connectors in question. Replacement of suspect connections with other types of connectors must also be supported by similar qualification documentation.

5. Complete the actions specified by this bulletin and provide a written report within 90 days of the date of this bulletin that either:

   a. States that no Bunker Ramo electrical penetration which use the hard epoxy module design are installed or planned to be installed in safety-related systems at your facility. (No further action is needed), or

   b. (1) Provides the results of those actions discussed in Items 1a, 1b, 1c, and 4 above, as they apply to penetration assemblies identified as either spare units or units not yet installed.

      (2) Provides the results of those actions discussed in Items 2 and 4 above, as they apply to plants under construction. The report must be submitted prior to issuance of an OL, if such action is contemplated within the 90 day period following the date of issuance of this bulletin.

      (3) Provides the results of those actions discussed in Items 3a, 3b, and 4 above, as they apply to operating plants, including your plan and schedule for completing the required inspections, and also provides your basis for continued operation.

6. Provide a report describing the results of the inspections discussed in Item 3b and addressed by the plan described in the report specified in 5b(3) above, within 60 days of completion of the inspections.

The written reports required by Items 5a, 5b(1), 5b(2), 5b(3), and 6 above shall be submitted to the appropriate Regional Administrator under oath or affirmation under provisions of Section 182a, Atomic Energy Act of 1954 as amended. The original copy of the cover letters and a copy of the reports shall be transmitted to the U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, D.C. 20555 for reproduction and distribution.

This request for information was approved by the Office of Management and Budget under clearance number 3150-0094 which expires on November 30, 1985. Comments on burden and duplication should be directed to the Office of Management and Budget, Reports Management, Room 3208, New Executive Office Building, Washington, D.C. 20503.

While no specific request or requirement is intended, the following information would be helpful to the NRC in evaluating the cost of implementing this bulletin:

1. Utility staff time to perform requested inspection.
2. Radiation exposure attributed to requested inspections.
3. Utility staff time spent to prepare written responses.

If you have any questions regarding this matter, please contact the Regional Administrator of the appropriate NRC Regional Office, or the technical contact listed below.

Richard C. DeYoung, Director
Office of Inspection and Enforcement

Technical Contact: V. D. Thomas
301-492-4755

Attachment:
1. List of Recently Issued IE Bulletins

TEMPORARY INSTRUCTION 2512/09

INSPECTION OF APPLICANT'S ACTIONS TAKEN IN RESPONSE TO IE BULLETIN NO. 82-04

2512/09-01 PURPOSE

To provide guidance for performing inspection of corrective actions taken by applicants to resolve deficiencies found in the hard epoxy module design type electrical penetration assembly manufactured by the Bunker Ramo Company.

2512/09-02 OBJECTIVE

To evaluate the adequacy of the repair or replacement actions taken by applicants to resolve the deficiencies found in the penetration assemblies at their sites. These deficiencies and those plants at which they were initially identified are discussed in IE Bulletin No. 82-04 (Enclosure 1).

2512/09-03 BACKGROUND

Defective electrical connections similar to those found in the containment electrical penetration assemblies supplied by the Bunker Ramo Company have been reported by the Midland, Calloway, Wolf Creek, and LaSalle Unit 2 nuclear power plants between early 1979 and mid-1982. These deficiencies include under- and over-crimping of electrical connectors, incorrectly sized connectors, loose connections on terminal blocks located inside terminal boxes, and cracks in the insulation of some conductors at the conductor-module interface. All deficiencies have been discovered in Bunker Ramo electrical penetration assemblies utilizing the hard epoxy module design. In addition to the aforementioned construction sites, Comanche Peak, Byron, and Braidwood sites also employ this type of penetration assembly.

To date, it has not yet been established that the hard epoxy modular design assembly manufactured by Bunker Ramo is being used or planned for use at any operating nuclear power plant. Since the above deficencies could result in failures of Class 1E equipment or systems and thereby compromise the health and safety of the public, IE Bulletin No. 82-04 was issued on December 3, 1982. Information Notice No. 82-40 (September 22, 1982) on the same subject (Enclosure 2) was issued earlier to inform the end-users of these assemblies of the potential problem.

2512/09-04 INSPECTION REQUIREMENTS

041 Replacement. If the applicant decides to initiate a replacement program involving other penetration assemblies considered more suitable for the service intended, then no special inspection is needed in response to IE Bulletin NO. 82-04. However, normal inspection effort established to examine a modification at a construction site should be undertaken by the Regional Office of the affected plant to assure that proper replacement of the suspect units has been accomplished.

042 Repair. If the applicant decides to initiate an extensive repair program to correct deficiencies identified in the subject penetration assemblies, the following information should be considered in order to facilitate the inspection/evaluation by the regional inspector.

a. Review applicant's sample size being used to determine adequacy of subject electrical connections. (IE Bulletin No. 82-04 specifies that the initial sample size that recipients shall use is the greater of two modules or 10% of the modules for each wire size being used.) If the applicant is proposing an expanded sample size, because deficiencies have been found, it is recommended that technical assistance be requested from IE to:

1. Review applicant's defective electrical connection rate which precipitated initiation of the increased sample size.

2. Review the adequacy of the proposed sample size.

b. Inspect 10% of the initial sample size specified in IE Bulletin No. 82-04 and verify that repaired electrical connectors have been restored to an acceptable standard as determined by using the instruction manuals provided by the manufacturer (Burndy Co., Amp Inc., etc.) of the electrical connectors being repaired.

c. Examples of salient points of information considered essential to effective inspection and evaluation of an applicant's repair program:

1. Verify that the proper crimping tools (i.e., model, size, etc.) were used to repair or replace faulty connections. Refer to the vendor's manual for proper correlation.

2. Verify the certification of crimping tools and assembly used to make repairs of various wire sizes.

3. Confirm that dimensions of actual electrical connections meet those dimensions specified in vendors instruction manual for any repair of a given wire size.

4. Confirm that the proper color code and embossed die code (as specified by the vendor of the connector) were used to repair faulty connections.

5. Observe general conditions surrounding the repair effort which may have an adverse affect on the restoration program (e.g., are penetration areas protected from chemical spray, direct impingement, or are the terminal box covers installed, sealed, or vented).

2512/09-05 REPORTING REQUIREMENTS

The regional inspector will maintain a record of his inspection data. These data will be used for assessing adequacy of licensee responses to IE Bulletin No. 82-04. Document your findings in the normal inspection report and forward copy to E. L. Jordan, Director, Division of Emergency Preparedness and Engineering Response, Office of Inspection and Enforcement, USNRC, Washington, DC 20555.

2512/09-06 EXPIRATION

This temporary instruction shall remain effective until the site inspections of the repair or replacement of electrical penetration units at the affected plants have been completed. Estimated completion date is January 31, 1984.

2512/09-07 IE CONTACT

Questions regarding this temporary instruction should be addressed to V. Thomas (301-492-4755).

2512/09-08 STATISTICAL DATA REPORTING

For 766 input, record the actual inspection effort against Module No. 25129B.

END

Initial Concern About Potential Problem in Operating Facilities

When IE Bulletin 82-04 was issued December 3, 1982, some 10 CFR Part 21 Defects and Noncompliance Reports had been issued by the Bunker Ramo Corporation. Additionally, some 10 CFR 50.55(e) Construction Deficiency Reports had been submitted by utilities and Bechtel. Enough information was available for NRC/IE to conclude that the potential problem was confined to a limited number of facilities with construction permits. On the other hand, there was concern at that time about the unknown magnitude of this potential problem in operating facilities. This uncertainty about operating facilities is mentioned in Temporary Instruction 2512/09, which was issued February 28, 1983.

APPENDIX B

Documentation of Bulletin Closeout

Table B.1 Bulletin Closeout Status

Facility	Utility	Docket Number	Facility Status	NRC Region	Utility Response Date	Closeout Status and Criterion
Arkansas 1	AP&L	50-313	OL	IV	03-03-83	Closed (2)
Arkansas 2	AP&L	50-368	OL	IV	03-03-83	Closed (4)
Bailly 1	NIPSCO	50-367	CD	III		Closed (1)
Beaver Valley 1	DL	50-334	OL	I	02-03-83	Closed (2)
Beaver Valley 2	DL	50-412	CP	I	01-28-83	Closed (2)
Bellefonte 1	TVA	50-438	CP	II	01-24-83	Closed (2)
Bellefonte 2	TVA	50-439	CP	II	01-24-83	Closed (2)
Big Rock Point 1	CPC	50-155	OL	III	02-28-83	Closed (2)
Braidwood 1	CECO	50-456	CP	III	03-03-83	Closed (2)
Braidwood 2	CECO	50-457	CP	III	03-03-83	Open
Browns Ferry 1	TVA	50-259	OL	II	01-24-83	Closed (2)
Browns Ferry 2	TVA	50-260	OL	II	01-24-83	Closed (2)
Browns Ferry 3	TVA	50-296	OL	II	01-24-83	Closed (2)
Brunswick 1	CP&L	50-325	OL	II	02-16-83	Closed (2)
Brunswick 2	CP&L	50-324	OL	II	02-16-83	Closed (2)
Byron 1	CECO	50-454	CP	III	03-03-83	Closed (2)
Byron 2	CECO	50-455	CP	III	03-03-83	Open
Callaway 1	UE	50-483	CP	III	02-23-83	Closed (4)
Callaway 2	UE	50-486	CD	III		Closed (1)
Calvert Cliffs 1	BG&E	50-317	OL	I	03-01-83	Closed (2)*
Calvert Cliffs 2	BG&E	50-318	OL	I	03-01-83	Closed (2)*
Catawba 1	DUPCO	50-413	CP	II	01-24-83	Closed (2)
Catawba 2	DUPCO	50-414	CP	II	01-24-83	Closed (2)
Cherokee 1	DUPCO	50-491	CHI	II		Closed (1)
Cherokee 2	DUPCO	50-492	CHI	II		Closed (1)
Cherokee 3	DUPCO	50-493	CHI	II		Closed (1)
Clinton 1	IP	50-461	CP	III	02-15-83	Closed (2)
Clinton 2	IP	50-462	CHI	III		Closed (1)

See notes at end of table.

* The soft epoxy assemblies replaced with Conax assemblies are not included in the scope of this Bulletin. Refer to Page A-6, first paragraph.

Table B.1 (contd.)

Facility	Utility	Docket Number	Facility Status	NRC Region	Utility Response Date	Closeout Status and Criterion
Comanche Peak 1	TUGCO	50-445	CP	IV	02-23-83 06-14-83	Open
Comanche Peak 2	TUGCO	50-446	CP	IV	02-23-83 06-14-83	Open
Cook 1	IMECO	50-315	OL	III	03-03-83	Closed (2)
Cook 2	IMECO	50-316	OL	III	03-03-83	Closed (2)
Cooper Station	NPPD	50-298	OL	IV	01-07-83	Closed (2)
Crystal River 3	FP	50-302	OL	II	01-07-83	Closed (2)
Davis-Besse 1	TECO	50-346	OL	III	02-28-83	Closed (2)
Diablo Canyon 1	PG&E	50-275	CP	V	02-02-83	Closed (2)
Diablo Canyon 2	PG&E	50-323	CP	V	02-02-83	Closed (2)
Dresden 1	CECO	50-10	SDI	III		Closed (1)
Dresden 2	CECO	50-237	OL	III	03-03-83	Closed (2)
Dresden 3	CECO	50-249	OL	III	03-03-83	Closed (2)
Duane Arnold	IELPCO	50-331	OL	III	01-06-83	Closed (2)
Farley 1	APCO	50-348	OL	II	01-03-83	Closed (2)
Farley 2	APCO	50-364	OL	II	01-03-83	Closed (2)
Fermi 2	DECO	50-341	CP	III	02-18-83	Closed (2)
FitzPatrick	PASNY	50-333	OL	I	02-28-83	Closed (2)
Forked River	JCP&L	50-363	CD	I		Closed (1)
Fort Calhoun 1	OPPD	50-285	OL	IV	01-12-83	Closed (2)
Fort St. Vrain	PSCC	50-267	OL	IV	12-29-82	Closed (2)
Ginna	RG&E	50-244	OL	I	01-25-83	Closed (2)
Grand Gulf 1	MP&L	50-416	LPTL	II	03-03-83	Closed (2)
Grand Gulf 2	MP&L	50-417	CHI	II	03-03-83	Closed (1)
Haddam Neck	CYAPCO	50-213	OL	I	02-22-83	Closed (2)
Harris 1	CP&L	50-400	CP	II	03-09-83	Closed (2)
Harris 2	CP&L	50-401	CP	II	03-09-83	Closed (2)
Harris 3	CP&L	50-402	CD	II		Closed (1)
Harris 4	CP&L	50-403	CD	II		Closed (1)
Hartsville A-1	TVA	50-518	CHI	II	01-24-83	Closed (1)
Hartsville A-2	TVA	50-519	CHI	II		Closed (1)
Hartsville B-1	TVA	50-520	CHI	II	01-24-83	Closed (1)
Hartsville B-2	TVA	50-521	CHI	II		Closed (1)

See notes at end of table.

Table B.1 (contd.)

Facility	Utility	Docket Number	Facility Status	NRC Region	Utility Response Date	Closeout Status and Criterion
Hatch 1	GP	50-321	OL	II	03-10-83	Closed (2)
Hatch 2	GP	50-366	OL	II	03-10-83	Closed (2)
Hope Creek 1	PSE&G	50-354	CP	I	03-03-83	Closed (2)
Hope Creek 2	PSE&G	50-355	CD	I	03-03-83	Closed (1)
Humboldt Bay 3	PG&E	50-133	SDI	V	03-03-83	Closed (1)
Indian Point 2	ConEd	50-247	OL	I	04-04-83	Closed (2)
Indian Point 3	PASNY	50-286	OL	I	01-24-83	Closed (2)
Jamesport 1	LILCO	50-516	CD	I		Closed (1)
Jamesport 2	LILCO	50-517	CD	I		Closed (1)
Kewaunee	WPS	50-305	OL	III	03-03-83	Closed (2)
LaCrosse	DP	50-409	OL	III	01-24-83	Closed (2)
LaSalle 1	CECO	50-373	OL	III	03-03-83	Closed (2)
LaSalle 2	CECO	50-374	CP	III	01-24-83 03-03-83	Closed (4)
Limerick 1	PECO	50-352	CP	I	02-15-83	Closed (2)
Limerick 2	PECO	50-353	CP	I	02-15-83	Closed (2)
Maine Yankee	MYAPCO	50-309	OL	I	01-18-83	Closed (2)
Marble Hill 1	PSI	50-546	CP	III	12-16-82	Closed (2)
Marble Hill 2	PSI	50-547	CP	III	12-16-82	Closed (2)
McGuire 1	DUPCO	50-369	OL	II	02-01-83	Closed (2)
McGuire 2	DUPCO	50-370	OL	II	02-01-83	Closed (2)
Midland 1	CPC	50-329	CP	III	12-30-82	Closed (3)
Midland 2	CPC	50-330	CP	III	12-30-82	Closed (3)
Millstone 1	NU	50-245	OL	I	02-22-83	Closed (2)
Millstone 2	NU	50-336	OL	I	02-22-83	Closed (2)
Millstone 3	NU	50-423	CP	I	06-17-83	Closed (2)
Monticello	NSP	50-263	OL	III	02-11-83	Closed (2)
Nine Mile Point 1	NMP	50-220	OL	I	01-13-83 01-20-83	Closed (2)
Nine Mile Point 2	NMP	50-410	CP	I	05-25-83	Closed (2)
North Anna 1	VEPCO	50-338	OL	II		Closed (2)*
North Anna 2	VEPCO	50-339	OL	II		Closed (2)*
North Anna 3	VEPCO	50-404	CD	II		Closed (1)
North Anna 4	VEPCO	50-405	CD	II		Closed (1)

See notes at end of table.

Table B.1 (contd.)

Facility	Utility	Docket Number	Facility Status	NRC Region	Utility Response Date	Closeout Status and Criterion
Oconee 1	DUPCO	50-269	OL	II	01-12-83	Closed (2)
Oconee 2	DUPCO	50-270	OL	II	01-12-83	Closed (2)
Oconee 3	DUPCO	50-287	OL	II	01-12-83	Closed (2)
Oyster Creek 1	JCP&L	50-219	OL	I	01-17-83	Closed (2)
Palisades	CPC	50-255	OL	III	02-28-83	Closed (2)
Palo Verde 1	APSCO	50-528	CP	V	03-02-83	Closed (2)
Palo Verde 2	APSCO	50-529	CP	V	03-02-83	Closed (2)
Palo Verde 3	APSCO	50-530	CP	V	03-02-83	Closed (2)
Peach Bottom 2	PECO	50-277	OL	I	01-26-83	Closed (2)
Peach Bottom 3	PECO	50-278	OL	I	01-26-83	Closed (2)
Perkins 1	DUPCO	50-488	CD	II		Closed (1)
Perkins 2	DUPCO	50-489	CD	II		Closed (1)
Perkins 3	DUPCO	50-490	CD	II		Closed (1)
Perry 1	CEI	50-440	CP	III	01-27-83	Closed (2)
Perry 2	CEI	50-441	CP	III	01-27-83	Closed (2)
Phipps Bend 1	TVA	50-553	CHI	II		Closed (1)
Phipps Bend 2	TVA	50-554	CHI	II		Closed (1)
Pilgrim 1	BECO	50-293	OL	I	01-07-83	Closed (2)
Point Beach 1	WEPCO	50-266	OL	III	12-17-82	Closed (2)
Point Beach 2	WEPCO	50-301	OL	III	12-17-82	Closed (2)
Prairie Island 1	NSP	50-282	OL	III	12-17-82	Closed (2)
Prairie Island 2	NSP	50-306	OL	III	12-17-82	Closed (2)
Quad Cities 1	CECO	50-254	OL	III	03-03-83	Closed (2)
Quad Cities 2	CECO	50-265	OL	III	03-03-83	Closed (2)
Rancho Seco 1	SMUD	50-312	OL	V	01-12-83 01-17-83	Closed (2)
River Bend 1	GSU	50-458	CP	IV	03-03-83	Closed (2)
River Bend 2	GSU	50-459	CHI	IV	03-03-83	Closed (1)
Robinson 2	CP&L	50-261	OL	II	03-15-83	Closed (2)
Salem 1	PSE&G	50-272	OL	I	03-01-83	Closed (2)
Salem 2	PSE&G	50-311	OL	I	03-01-83	Closed (2)

See notes at end of table.

* Per the Memorandum of April 19, 1983 to E. L. Jordan (NRC/IE HQ) from J. A. Olshinski (NRC Region II), there are no affected assemblies in NRC Region II.

Table B.1 (contd.)

Facility	Utility	Docket Number	Facility Status	NRC Region	Utility Response Date	Closeout Status and Criterion
San Onofre 1	SCE	50-206	OL	V	03-03-83	Open
San Onofre 2	SCE	50-361	OL	V	03-03-83	Closed (2)
San Onofre 3	SCE	50-362	OL	V	03-03-83	Closed (2)
Seabrook 1	PSNH	50-443	CP	I	02-25-83	Closed (2)
Seabrook 2	PSNH	50-444	CP	I	02-25-83	Closed (2)
Sequoyah 1	TVA	50-327	OL	II	01-24-83	Closed (2)
Sequoyah 2	TVA	50-328	OL	II	01-24-83	Closed (2)
Shoreham	LILCO	50-322	CP	I	03-03-83	Closed (2)
South Texas 1	HL&P	50-498	CP	IV	01-26-83	Closed (2)
South Texas 2	HL&P	50-499	CP	IV	01-26-83	Closed (2)
St. Lucie 1	FPL	50-335	OL	II	02-28-83	Closed (2)
St. Lucie 2	FPL	50-389	CP	II	02-28-83	Closed (2)
Sterling	RG&E	50-485	CD	I		Closed (1)
Summer 1	SCE&G	50-395	OL	II	01-05-83	Closed (2)
Surry 1	VEPCO	50-280	OL	II	02-04-83	Closed (2)
Surry 2	VEPCO	50-281	OL	II	02-04-83	Closed (2)
Susquehanna 1	PP&L	50-387	OL	I	01-03-83	Closed (2)
Susquehanna 2	PP&L	50-388	CP	I	01-03-83	Closed (2)
TMI 1	Met-Ed	50-289	OL	I	05-20-83	Closed (2)
TMI 2	Met-Ed	50-320	SDI	I	06-13-83	Closed (1)
Trojan	PGE	50-344	OL	V	02-18-83	Closed (2)
Turkey Point 3	FPL	50-250	OL	II	02-09-83 02-10-83	Closed (2)
Turkey Point 4	FPL	50-251	OL	II	02-09-83 02-10-83	Closed (2)
Vermont Yankee 1	VYNP	50-271	OL	I	01-10-83	Closed (2)
Vogtle 1	GP	50-424	CP	II	02-25-83	Closed (2)
Vogtle 2	GP	50-425	CP	II	02-25-83	Closed (2)
WNP 1	WPPSS	50-460	CP	V	01-17-83	Closed (2)
WNP 2	WPPSS	50-397	CP	V	01-27-83	Closed (2)
WNP 3	WPPSS	50-508	CP	V	01-03-83	Closed (2)
WNP 4	WPPSS	50-513	CD	V	01-17-83	Closed (1)
WNP 5	WPPSS	50-509	CD	V	01-03-83	Closed (1)

See notes at end of table.

Table B.1 (contd.)

Facility	Utility	Docket Number	Facility Status	NRC Region	Utility Response Date	Closeout Status and Criterion
Waterford 3	LP&L	50-382	CP	IV	01-12-83	Closed (2)
Watts Bar 1	TVA	50-390	CP	II	01-24-83	Closed (2)
Watts Bar 2	TVA	50-391	CP	II	01-24-83	Closed (2)
Wolf Creek 1	KG&E	50-482	CP	IV	02-23-83	Closed (4)
Yankee-Rowe 1	YAECO	50-29	OL	I	01-13-83	Closed (2)
Yellow Creek 1	TVA	50-566	CHI	II	01-24-83	Closed (1)
Yellow Creek 2	TVA	50-567	CHI	II	01-24-83	Closed (1)
Zimmer 1	CG&E	50-358	CD	III		Closed (1)
Zion 1	CECO	50-295	OL	III	03-03-83	Closed (2)
Zion 2	CECO	50-304	OL	III	03-03-83	Closed (2)

Notes:
1. Facility status is based on References 1 and 2, Page 4.
2. The following abbreviations apply to facility status:
   CD, Cancelled
   CHI, Construction Halted Indefinitely
   CP, Construction Permit
   LPTL, Low Power Testing License
   OL, Operating License
   SDI, Shut Down Indefinitely
3. Refer to Pages 3 and 4 for Bulletin closeout criteria.

Table B.2 List of 10 CFR 50.55(e) Construction Deficiency Reports Used for Bulletin Closeout

Facility	Report No. and Date		Attachment and Date
Midland 1 & 2	16-79	01-15-79	Bechtel MCAR 26, 12-19-78; Bechtel Interim Report 1, MCAR 26, 01-08-79
	82-02 #1	02-19-82	Bechtel MCAR 56, 02-09-82 & 02-17-82
	82-02 #2	04-08-82	Bechtel Interim Report 2, MCAR 56, 03-17-82
	82-02 #3	06-09-82	Bechtel Final Report 3, MCAR 56, 05-26-82

Note: The Bulletin has been closed out for these facilities per Criterion 3 (Page 3).

Table B.3 List of NRC/IE Inspection Reports Used for Bulletin Closeout

Facility	Inspection Report Number and Approval Date	
Arkansas 2	50-368/83-10	06-14-83
Callaway 1	50-483/83-13	06-29-83
LaSalle 2	50-374/83-18	08-24-83
Wolf Creek 1	50-482/83-21	09-01-83

Note: The Bulletin has been closed out for these facilities per Criterion 4 (Page 4).

Table B.4 List of Deficiency Reports

Callaway 1

March 26, 1980, Union Electric Company (UE) 10 CFR 50.55(e) Deficiency Report No. ULNRC-342 was issued to NRC Region III. The verbal notification of February 26, 1980 was confirmed.

May 6, 1980, SNUPPS 10 CFR 50.55(e) Deficiency Report No. SLNRC 80-22 was issued to NRC Region I. The Bechtel Power Corporation (BPC) Report of May 5, 1980 was enclosed. It was pointed out that the deficiencies applied to all SNUPPS units.

June 12, 1980, SNUPPS 10 CFR 50.55(e) Deficiency Report No. SLNRC 80-30 was issued to NRC Region I to describe further concerns, as a supplement to Report No. SLNRC 80-22.

March 17, 1980, Bunker Ramo Corporation (BRC) 10 CFR Part 21 Defect and Noncompliance Report No. FIAR 0001 was issued.

May 12, 1980, BRC Report No. FIAR 0001 was transmitted to BPC.

May 14, 1981, SNUPPS final 10 CFR 50.55(e) Deficiency Report No. SLNRC 81-30 was issued to NRC Region III, as a supplement to Report No. SLNRC 80-30.

LaSalle 2

October 2, 1980, a Commonwealth Edison (CECO) 10 CFR 50.55(e) Deficiency Report was issued to NRC Region III. The verbal notification of September 3, 1980 was confirmed.

January 24, 1983, CECO 10 CFR 50.55(e) updated Deficiency Report No. 82-08 was issued to NRC Region III.

March 1, 1983, CECO 10 CFR 50.55(e) final Deficiency Report No. 82-08 was issued to NRC Region III.

Midland 1 and 2

February 19, 1982, Consumers Power Company (CPC) 10 CFR 50.55(e) Deficiency Report No. 82-02 #1 was issued to NRC Region III. Bechtel Associates Professional Corporation (BAPC) Reports MCAR 56 of February 9, 1982 and February 17, 1982 were attached.

April 8, 1982, CPC 10 CFR 50.55(e) Deficiency Report No. 82-02 #2 was issued to NRC Region III. BAPC Interim Report 2, MCAR 56, of March 17, 1982 was attached.

Table B.4 (contd.)

June 9, 1982, CPC 10 CFR 50.55(e) Deficiency Report No. 82-02 #3 was issued to NRC Region III. BAPC Report No. MCAR 56 (Revised) of May 26, 1982 was attached.

March 26, 1982, Bunker Ramo Corporation (BRC) 10 CFR Part 21 Defect and Noncompliance Report No. FIAR 0002 was issued to NRC Region V. Because CPC personnel of all other facilities have reported that they have no affected assemblies, it is clear that this BRC report refers to Midland 1 and 2.

Wolf Creek 1

May 6, 1980, SNUPPS 10 CFR 50.55(e) Deficiency Report No. SLNRC 80-22 was issued to NRC Region I. The Bechtel Power Corporation (BPC) Report of May 5, 1980 was enclosed. It was pointed out that the deficiencies were generic, applying to all SNUPPS units.

June 12, 1980, SNUPPS 10 CFR 50.55(e) Deficiency Report No. SLNRC 80-30 was issued to NRC Region I to describe further concerns, as a supplement to Report No. SLNRC 80-22.

May 14, 1981, SNUPPS final 10 CFR 50.55(e) Deficiency Report No. SLNRC 81-30 was issued to NRC Region III, as a supplement to Report No. SLNRC 80-30.

Table B.5 List of Affected Circuits, Wire Sizes and Modules Reported by Utility Personnel

Braidwood 2

The following table and notes are based on the Commonwealth Edison response of March 3, 1983.

Spec. Item No.	Equip. No.	Penetration No.	Segregation Code	Note
Item 4	2RY04E	E16	2P1B	3
	2RY05E	E10	2P2B	3
	2RY06E	E9	2P2B	3
	2RY07E	E17	2P1B	3
Item 5	2RD12E	E31	2P2B	3
	2RD13E	E32	2P2B	3
	2RD15E	E37	2P2B	3
	2RD16E	E38	2P2B	3
	2RD17E	E39	2P2B	3
Item 6	2SI01E	E45	2P1E	3
	2SI02E	E11	2P2E	3
Item 7	2AP85EA	E48	2P1B	3
	2AP85EB	E41	2P2B	3
	2AP85EC	E8	2P2B	3
	2AP85ED	E19	2P1B	3
Item 8A	2SI03E	E44	2C1E	1
	2SI04E	E12	2C2E	1
Item 8B	2LV01E	E43	2C1B	1
	2LV02E	E18	2C1B	1
	2LV03E	E6	2C2B	1
	2LV04E	E5	2C2B	1
Item 9A	2SI05E	E24	2K1R	1,2
	2SI06E	E35	2K2R	1,2
	2SI07E	E51	2K3R	1,2
	2SI08E	E7	2K4R	1,2
Item 9B	2LV05E	E46	2K1B	1,2
	2LV06E	E13	2K2B	1,2
Item 9C	2LV07E	E25	2K1B	1,2
	2LV08E	E29	2K2B	1,2
Item 12	2CQ01E	A	2C1B	1
	2CQ02E	B	2C1B	1

Notes:
1. All connections at terminal blocks were inspected. Crimp depth and configuration appeared to be non-uniform. The need to replace these connections was being reviewed.

Table B.5 (contd.)

2. These conductors insulated with a single Raychem heat shrink sleeve were inspected, and no evidence of cracking was found.
3. Because these items are to be replaced with Conax modules, they were not inspected.
+4. Because #2 AWG and smaller in-line crimps are to be replaced, they were not inspected.
+5. None of the items listed had been installed.

+ General note

Byron 2

The following table and notes are based on the Commonwealth Edison response of March 3, 1983.

	(1a) Supplier Penetration Terminal Boxes	(1b) Insulated Conductors Entering/Exiting Epoxy Modules	(1c) In-Line Butt Splices	Note
2VP01E				
2VP02E				
2VP03E				
2VP04E				
2SI01E		X*	X*	
2SI02E		X*	X*	
2SI03E	X	X**		1
2SI04E	X	X**		1
2SI05E	X	X		1,2
2SI06E	X	X		1,2
2SI07E	X	X		1,2
2SI08E	X	X		1,2
2NR01E				
2NR02E				
2NR03E				
2NR04E				

Notes:
X = Exists in penetration
* = To be replaced with Conax Adapter Modules, hence not inspected
** = Previously inspected prior to penetration installation, not re-inspected

Table B.5 (contd.)

Notes:

1. All vendor-supplied terminations to terminal boxes were hand pulled on safety-related penetrations 2SI03E, 2SI04E 2SI05E, 2SI06E, 2SI07E and 2SI08E. From a total of 2626 connections, eight pulled apart, representing 0.3% of total. Crimping of the lugs was observed to be adequate with the exception of the strain relief portions of the lugs which were observed to be not tightly crimped down on conductor insulation.

   All lugs were observed to be of proper size and type, 40 conductors were determinated from the terminal block and size verified by manufacturers markings on the lug.

   All lugs were observed to be tightly connected to the terminal blocks.

   Penetrations 2SI05E, 2SI06E, 2SI07E and 2SI08E with #16 conductors were inspected for integrity of conductor insulation at the entry into the epoxy module. No evidence of loss of conductor insulation integrity was observed. Penetrations 2SI03E and 2SI04E with #14 conductors were previously inspected for insulation integrity at conductor entry and exit of module, prior to penetration installation, and no loss of conductor insulation integrity was observed at that time.
2. Three feedthrus were removed from the total of 24 #16 feedthrus on penetrations 2SI05E, 2SI06E, 2SI07E and 2SI08E. Each feedthru removed was inspected for loss of conductor insulation integrity where the conductors enter and exit the epoxy module. No cracking or loss of insulation integrity was observed. No sample of #14 conductor feedthrus was removed since all were examined previously, prior to installation of the penetrations.

+3. No inspections were performed for vendor-supplied in-line butt splices, since all feedthrus of this type are to be replaced with Conax Adapter Modules.

+4. All connections which pulled apart during the pull test have been reterminated with a replacement lug and calibrated crimp tool.

+5. The incomplete crimps on the strain relief portion of terminal lugs have been documented on CECO Non-Conformance Report F788 for Engineering disposition.

+ General note

Table B.5 (contd.)

Comanche Peak 1 and 2

The following list of inspected Bunker Ramo-supplied electrical penetrations and applicable notes are based on the Texas Utilities Generating Company response of June 14, 1983.

Penetrations	Conductor Size, AWG	Pull-Out Test Force, lb.	Note
1E6			
1E9			
1E10			
1E11			
1E12	#2	180	2
1E13			
1E15			
1E16			
1E17			
1E18			
1E29			
1E31			
1E39			
1E40			
1E45			
1E47			
1E56			
1E57			
1E58			
1E59	#2	180	2
1E60			
1E61			
1E62			
1E63			
1E64			
1E66			
1E76			
1E77			
1E78			
1E79			
1E80			1
1E81			1
2E6			
2E9			
2E10	#6, 8, 10	100, 90, 80	3
2E11			
2E12	#2	180	2
2E13			

Table B.5 (contd.)

Penetrations	Conductor Size, AWG	Pull-Out Test Force, lb.	Note
2E15			
2E16			
2E17			
2E18			
2E29			
2E31			
2E39			
2E40			
2E45			
2E47			
2E56	#6, 8, 10	100, 90, 80	3
2E57			
2E58			
2E59	#2	180	2
2E60			
2E61			
2E62			
2E63			
2E64			
2E66			
2E76	#6	100	3
2E77	#6	100	3
2E78	#12	70	3
2E79	#12	70	3
2E80			1
2E81			1

Notes:

1. Bunker Ramo Corporation (BRC) provided terminal boxes for these penetrations. Each box contained eight #12 AWG conductors with terminal lugs installed by BRC. New site-procured lugs were installed per Electrical Engineering instructions. The crimping tools were calibrated per site procedures. All activities were witnessed per site procedures by Quality Control personnel.
2. Two in-line butt splices used for #2 AWG conductors failed at 150 pounds of pull force, out of a total of six tested. All butt splices used for #2 conductors were to be replaced with site-procured splices. All crimping tools were to be calibrated per site procedures. All activities were to be witnessed per site procedures by Quality Control personnel.
3. The in-line butt splices used for #6, #8, #10 and #12 AWG conductors passed the pull test. These splices were to be used as made by BRC. Testing was witnessed by Quality Control personnel.

Table B.5 (contd.)

+4. A minimum random sample of 25% of in-line butt splices of each wire size installed by BRC was inspected. This sampling included at least two complete modules. At the conclusion of inspection, a random sample of 10% of the inspected splices of each size was subjected to a one minute direct pull test.
+5. The insulation at penetration modules was inspected for damage and was found to be satisfactory. Inspection was witnessed by Quality Control personnel.
+6. As mentioned in Item 1C of the response, the sample conductors were selected from the penetrations designated for use in Unit 2. This decision was made on the basis of accessibility and was justified per BRC documentation.

+ General note

Table B.6 List of Facilities with Affected Assemblies, Including Inspection Findings and Replacement/ Repair Status

Arkansas 2

Facility Status: OL
Utility Response Date: 03-03-83

Inspection Findings:
Spare assemblies were inspected per Action Item 1 of the Bulletin and were found to be satisfactory. In accordance with Action Item 3, job orders, LERs and maintenance history were reviewed; no problems such as described in the Bulletin were found.
Replacement/Repair Status:
Per the utility response, no corrective actions were required.

Braidwood 2

Facility Status: CP
Utility Response Date: 03-03-83

Inspection Findings:
Refer to Table B.5.
Replacement/Repair Status:
Refer to Table B.5.

Byron 2

Facility Status: CP
Utility Response Date: 03-03-83

Inspection Findings:
There were no spare affected assemblies. A total of 2626 connections to terminal boxes were hand pulled; eight of these connections pulled apart. Crimping of lugs was observed to be adequate, except that strain relief portions of the lugs were not crimped tightly to conductor insulation. All lugs were observed to be of proper size and shape, and to be connected tightly to the terminal blocks. Insulation of three #16 conductors was determined to be adequate at entry into the epoxy module. Insulation of two #14 conductors had been inspected previously and found to be adequate. Three of 24 total #16 feedthrus were removed for inspection and were found to be satisfactory. All #14 feedthrus had been inspected previously and found to be acceptable.
Replacement/Repair Status:
The eight connections which pulled apart during hand testing were reterminated with a replacement lug and a calibrated crimping tool. All feedthrus with vendor-supplied in-line butt splices were to be replaced with Conax adapter modules. Affected circuits, wire sizes and modules are listed in Table B.5.

Table B.6 (contd.)

Callaway 1 — Facility Status: CP
Utility Response Date: 02-23-83

Inspection Findings:
Deficiency reports issued before the Bulletin are mentioned in the utility response of February 23, 1983. Overcrimping and undercrimping of lugs, loose terminal screws and damaged cables are described in the Bechtel 10 CFR 50.55(e) report of May 5, 1980. SNUPPS issued supplementary Report SLNRC 80-30 on June 12, 1980, to identify further deficiencies and concerns and to expand the replacement/repair program. Although the SNUPPS report is based on additional inspections at Wolf Creek 1, it applies to Callaway 1 as well because continuing difficulties with Bunker Ramo items caused concern about effectiveness of the supplier's quality program. Per SNUPPS final deficiency report SLNRC 81-30 of May 14, 1981, the #16-22 AWG drain wire lugs were found to be properly crimped; lugs larger than #10 AWG were inspected 100%; and a number of installed 250, 350 and 500 MCM size cables were found without proper identification.
Replacement/Repair Status:
Per the SNUPPS deficiency report of June 12, 1980, all terminations #12 or smaller were to be replaced, and the relatively few larger terminations were to be inspected to determine the need for replacement; loose terminal screws were to be tightened during inspection or replacement of connectors; and handling mishaps and damaged cables were to be handled in accordance with existing site non-conformance control procedures. Per the SNUPPS final deficiency report of May 14, 1981, pigtail terminal lugs sizes #10, 12, 14 and 16 AWG were replaced; some improperly crimped 2/0 lugs were replaced; some unidentified cables were to be replaced with cables properly identified and qualified; and measures had been taken to terminate further work with Bunker Ramo. Per the SNUPPS response of 02-23-83, all affected assemblies were inspected and were reworked as required.

Comanche Peak 1 and 2 — Facility Status: CP
Utility Response Date: 02-23-83
06-14-83

Inspection Findings:
Sixty-four penetrations were inspected for potential insulation damage at entry and exit of modules and were found to be satisfactory. For remaining inspections, refer to Table B.5.
Replacement/Repair Status:
Refer to Table B.5.

Table B.6 (contd.)

LaSalle 2 — Facility Status: CP
Utility Response Date: 01-24-83
03-03-83

Inspection Findings:
All ring lug terminations in BRC terminal boxes were to be inspected. In-process inspection of electrical penetrations was performed during final installation, and no cracking was observed.
Replacement/Repair Status:
Affected modules/penetrations had been repaired by BRC and were reinstalled without cracking. All BRC epoxy modules with a butt splice on each side were to be replaced with Conax modules.

Midland 1 and 2 — Facility Status: CP
Utility Response Date: 12-30-82

Inspection Findings:
Per final 10 CFR 50.55(e) Report 82-02 #3 of May 26, 1982, insulation chewed by rodents, cracked insulation, inadequately crimped in-line butt splices and one cracked sealing surface were identified as deficiencies.
Replacement/Repair Status:
Rodent controls were reemphasized, all EPAs were to be sealed to prevent the reentry of rodents, rodent damage was being repaired per BRC repair/replacement procedures, all modules #2 AWG through #20 AWG were being replaced with qualified modules, and the single cracked module was to be replaced.

San Onofre 1 — Facility Status: OL
Utility Response Date: 03-03-83

Inspection Findings:
Per Action Item 1 of the Bulletin, two spare instrumentation penetrations similar to affected assemblies were inspected for splices, faulty insulation, cracked epoxy and sealing and were found to be satisfactory. Per Action Item 3 of the Bulletin, no problems with the two power and control penetrations were found from review of maintenance files and questioning of maintenance and operational personnel.
Replacement/Repair Status:
Per the utility response, no corrective actions were required. Followup by NRC/IE is suggested to verify the utility's statement.

Wolf Creek 1 — Facility Status: CP
Utility Response Date: 02-23-83

Table B.6 (contd.)

Inspection Findings:
Deficiency reports issued before the Bulletin are mentioned in the utility response of February 23, 1983. Overcrimping and undercrimping of lugs, loose terminal screws and damaged cables are described in the Bechtel 10 CFR 50.55(e) report of May 5, 1980. SNUPPS issued supplementary Report SLNRC 80-30 on June 12, 1980, to identify further deficiencies and concerns and to expand the replacement/repair program. As mentioned in the SNUPPS report, continuing difficulties with Bunker Ramo items caused concern about effectiveness of the supplier's quality program. Per SNUPPS final deficiency report SLNRC 81-30 of May 14, 1981, the #16-22 AWG drain wire lugs were found to be properly crimped; lugs larger than #10 AWG were inspected 100%; and a number of installed 250, 350 and 500 MCM size cables were found without proper identification.
Replacement/Repair Status:
Per the SNUPPS deficiency report of June 12, 1980, all terminations #12 or smaller were to be replaced, and the relatively few larger terminations were to be inspected to determine the need for replacement; loose terminal screws were to be tightened during inspection or replacement of connectors; and handling mishaps and damaged cables were to be handled in accordance with existing site non-conformance control procedures. Per the SNUPPS final deficiency report of May 14, 1981, pigtail terminal lugs sizes #10, 12, 14 and 16 AWG were replaced; some improperly crimped 2/0 lugs were replaced; some unidentified cables were to be replaced with cables properly identified and qualified; and measures had been taken to terminate further work with Bunker Ramo. Per the SNUPPS response of 02-23-83, all affected assemblies were inspected and were reworked as required.

APPENDIX C

Proposed Followup Items

APPENDIX C

Proposed Followup Items

Region III

1. Braidwood 2

   Utility personnel responded acceptably March 3, 1983, indicating that (a) all affected Bunker Ramo Corporation (BRC) electrical penetration assemblies were on site but had not been installed, (b) the need to replace certain BRC components was being reviewed, (c) the decision to replace certain other BRC components with Conax modules had been made and (d) all BRC components had been inspected except those being replaced with Conax modules.

   Affected circuits, wire sizes and modules reported by utility personnel are listed in Table B.5 of this report.

   Verification that repairs and replacements have been completed in accordance with instructions specified in TI 2512/09 is incomplete or not fully documented.

2. Byron 2

   Utility personnel responded acceptably March 3, 1983, indicating that (a) all affected Bunker Ramo Corporation (BRC) electrical penetration assemblies had been installed, (b) of 2626 total terminal box terminations which were hand pulled, eight failed and were replaced, (c) conductor insulation at entry into the epoxy module had retained its integrity, (d) all lugs were observed to be of proper size and type and to be connected tightly to the terminal blocks, (e) in three feedthrus removed from a total of 24 #16 feedthrus, no cracking or loss of insulation integrity was observed, (f) all #14 feedthrus had been inspected before installation, and no deficiencies had been found, and (g) incomplete crimps on the strain relief portion of terminal lugs had been documented per CECO Non-Conformance Report F788 for disposition.

   Inspection findings and replacement/repair status are summarized in Table B.6. Affected circuits, wire sizes and modules are listed in Table B.5.

   Verification that repairs and replacements have been completed in accordance with instructions specified in TI 2512/09 is incomplete or not fully documented.

3. Midland 1 and 2

Utility personnel responded December 30, 1982, pointing out that their final 10 CFR 50.55(e) Construction Deficiency Report 82-02 #3 dated May 26, 1982 had been submitted June 9, 1982 to resolve the problem with Bunker Ramo Corporation electrical penetration assemblies.

On the basis of the Utility Response and Report 82-02 #3, the Bulletin has been closed out for this facility. Corrective action is to be tracked by NRC/IE as a 10 CFR 50.55(e) item.

Inspection findings and replacement/repair status are summarized in Table B.6.

Verification that repairs and replacements have been completed in accordance with instructions specified in TI 2512/09 is incomplete or not fully documented.

Region IV

Comanche Peak 1 and 2

Utility personnel responded acceptably June 14, 1983, indicating that (a) new site-procured lugs had been installed to replace those installed by Bunker Ramo Corporation (BRC), (b) no conductors with defective insulation were found in BRC assemblies and (c) site-procured in-line butt splices were to be installed to replace #2 AWG BRC conductors.

Inspection findings and replacement/repair status are summarized in Table B.6.

Verification that repairs and replacements have been completed in accordance with instructions specified in TI 2512/09 is incomplete or not fully documented.

Region V

San Onofre 1

Utility personnel responded acceptably March 3, 1983, indicating that some affected assemblies were installed, that others were set aside as spares, and that none required corrective action.

Inspection findings are summarized in Table B.6.

Verification that the affected assemblies were inspected in accordance with the requirements of IE Bulletin 82-04 is incomplete or not fully documented.

APPENDIX D

Utility Staff Time and Radiation Exposure

APPENDIX D

Utility Staff Time and Radiation Exposure

Facility	Item 1 Utility Staff Time to Perform Requested Inspection, Manhours	Item 2 Radiation Exposure Attributed to Requested Inspections	Item 3 Utility Staff Time Spent to Prepare Written Response, Manhours
Beaver Valley 1	0	0	70
Byron 1	100	0	6
Byron 2	100	0	6
Catawba 1	0	0	1
Catawba 2	0	0	1
Comanche Peak 1	775*	0	--
Comanche Peak 2	775*	0	--
Fort Calhoun 1	0	0	10
Ginna	0	0	1
Grand Gulf 1	0	0	1.5
Grand Gulf 2	0	0	1.5
Haddam Neck	0	0	7.5
Kewaunee	0	0	10
LaCrosse	0	0	5
Millstone 1	0	0	7.5
Millstone 2	0	0	7.5
Monticello	0	0	12
Peach Bottom 2	2.5	0	1.5
Peach Bottom 3	2.5	0	1.5
Point Beach 1	0	0	2
Point Beach 2	0	0	2
South Texas 1	0	0	1
South Texas 2	0	0	1
Trojan	4	0	9
Total	1759	0	165.5
Per Facility Reporting	73.3	0	6.9

*1550 manhours have been reported for both Comanche Peak units for Items 1 and 3 combined.

Note:
As mentioned on Page 6 of the Bulletin (Page A-9, this report), this information was requested (not required) to evaluate the cost of implementing IEB 82-04.

APPENDIX E

Abbreviations

APPENDIX E

Abbreviations

APCO	Alabama Power Company
AP&L	Arkansas Power & Light Company
APSCO	Arizona Public Service Company
AWG	American Wire Gage
BAPC	Bechtel Associates Professional Corporation
BECO	Boston Edison Company
BG&E	Baltimore Gas and Electric Company
BPC	Bechtel Power Corporation
BRC	Bunker Ramo Corporation
CD	Cancelled
CECO	Commonwealth Edison Company
CEI	Cleveland Electric Illuminating Company
CFR	Code of Federal Regulations
CG&E	Cincinnati Gas and Electric Company
CHI	Construction Halted Indefinitely
ConEd	Consolidated Edison Company of New York, Inc.
CP	Construction Permit
CPC	Consumers Power Company
CP&L	Carolina Power & Light Company
CR	Contractor's Report
CRGR	Committee to Review Generic Requirements
CYAPCO	Connecticut Yankee Atomic Power Company
DECO	Detroit Edison Company
DL	Duquesne Light Company
DP	Dairyland Power Cooperative
DQASIP	Division of Quality Assurance Safeguard Inspection Program
DUPCO	Duke Power Company
EPA	Electrical Penetration Assembly
FIAR	Failure Investigation and Analysis Report
FP	Florida Power Corporation
FPL	Florida Power & Light Company
GP	Georgia Power Company
GSU	Gulf States Utilities Company
HL&P	Houston Lighting & Power Company
HQ	Headquarters
IEB	Inspection/Enforcement Bulletin
IELPCO	Iowa Electric Light and Power Company
IMECO	Indiana & Michigan Electric Company
IN	Information Notice
IP	Illinois Power Company
JCP&L	Jersey Central Power & Light Company
KG&E	Kansas Gas and Electric Company
LILCO	Long Island Lighting Company
LP&L	Louisiana Power and Light Company

LPTL	Low Power Testing License
MCAR	Management Corrective Action Report
Met-Ed	Metropolitan Edison Company
MP&L	Mississippi Power & Light Company
MYAPCO	Maine Yankee Atomic Power Company
NIPSCO	Northern Indiana Public Service Company
NMP	Niagara Mohawk Power Corporation
NPPD	Nebraska Public Power District
NRC/IE	Nuclear Regulatory Commission/ Office of Inspection and Enforcement
NSP	Northern States Power Company
NU	Northeast Nuclear Energy Company, Northeast Utilities
OL	Operating License
OMB	Office of Management and Budget
OPPD	Omaha Public Power District
PASNY	Power Authority of the State of New York
PECO	Philadelphia Electric Company
PGE	Portland General Electric Company
PG&E	Pacific Gas and Electric Company
PP&L	Pennsylvania Power and Light Company
PSCC	Public Service Company of Colorado
PSCO	Public Service Company of Oklahoma
PSE&G	Public Service Electric and Gas Company
PSI	Public Service Indiana
PSNH	Public Service Company of New Hampshire
RG&E	Rochester Gas and Electric Corporation
SCE	Southern California Edison Company
SCE&G	South Carolina Electric & Gas Company
SDI	Shut Down Indefinitely
SMUD	Sacramento Municipal Utility District
SNUPPS	Standardized Nuclear Unit Power Plant Systems
SSINS	Standard Subject Identification Number System
TECO	Toledo Edison Company
TI	Temporary Instruction
TMI	Three Mile Island
TUGCO	Texas Utilities Generating Company
TVA	Tennessee Valley Authority
UE	Union Electric Company
VEPCO	Virginia Electric and Power Company
VYNP	Vermont Yankee Nuclear Power Corporation
WEPCO	Wisconsin Electric Power Company
WNP	Washington Nuclear Project
WPPSS	Washington Public Power Supply System
WPS	Wisconsin Public Service Corporation
YAECO	Yankee Atomic Electric Company

NRC FORM 335 (11-81)

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16. ABSTRACT (200 words or less)

IE Information Notice 82-40 was issued September 22, 1982 as an early notification of a potentially significant problem pertaining to electrical penetration assemblies (EPAs) supplied by the Bunker Ramo Corporation (BRC) of Chatsworth, California. All deficiencies described in the Notice were identified as existing in BRC EPAs with a hard epoxy module design. Utility personnel were asked to review the Notice and take appropriate actions, but were not required to respond or take any specific action. After further study, NRC concluded that there were potential generic safety implications at a limited number of plants. Accordingly, IE Bulletin 82-04 was issued December 3, 1982 to require responses and specific actions by all licensees and holders of construction permits. Evaluation of utility responses, deficiency reports and NRC/IE inspection reports has resulted in Bulletin closeout for 124 of the 129 current facilities. Deficiencies described in the Bulletin were identified at 11 facilities, of which two are operating and nine are under construction. Followup of corrective actions and verification of inspection procedures are proposed in Appendix C for the five facilities with open status. Inspection findings and the replacement/repair status of the 11 facilities with affected assemblies are summarized in Table B.6. Completion by NRC/IE of all the followup items identified in Appendix C is expected to resolve fully the specific problem of Bunker Ramo electrical penetrations that utilized a hard epoxy design.

17. KEY WORDS AND DOCUMENT ANALYSIS

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JULY 1984